FAO Plant Protection Bulletin

VOL. III, No. 8 — A Publication of the — MAY 1955

World Reporting Service on Plant Diseases and Pests

Diseases of Economic Crops in the Sudan

III. Fodders, Pulses and Vegetables

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THESE notes, which conclude this series,[1] deal with the more important diseases of fodder, pulse and vegetable crops in the Sudan.

Fodders

Dolichos bean. The chief cultivated fodder crop in the northern Sudan is dolichos bean (*Dolichos lablab*), of which annual acreage may reach nearly 100,000 acres. In the Gezira it is often severely attacked by rain-spread bacterial blight (*Xanthomonas phaseoli*) if grown during the rainy season; consequently sowing is usually delayed until the end of the rains, generally in September. North of Khartoum rainfall is light and the disease causes only minor damage. Seed selection and treatment with organo-mercurial dressings eliminate much of the seed-borne infection but are of little practical use unless combined with crop sanitation measures to prevent carry-over on trash and volunteer seedlings. In field trials certain introduced dolichos varieties suffered less severely in that they were more vigorous and able to survive attack better than local varieties.

Ashy stem blight, caused by *Macrophomina phaseoli*, is sometimes destructive over small areas where environmental conditions are unfavorable to growth, as in waterlogged soil or following insect attacks of the roots by termites or chafer grubs. A conspicuous bright yellow and green mosaic with a varying amount of leaf distortion sometimes occurs on dolichos in the northern Sudan and may be of virus origin; at present it is of no economic importance and has not been investigated. Sooty mould, consisting largely of dematoid fungi (predominantly species of *Cladosporium* and *Alternaria*) usually growing on insect honeydew, often occurs on leaves, stems and pods in the northern Sudan. No doubt control of the insect concerned would eliminate sooty mould but this is not at present necessary.

Lucerne. Lucerne (*Medicago sativa*) is cultivated on a small scale, mostly in the north where rust (*Uromyces striatus*), mildew (*Leveillula taurica*) and sooty mould (as above) sometimes cause appreciable damage. Leaf spotting caused by *Cercospora zebrina* occasionally occurs in the north and that caused by *Pseudoplea trifolii* in the wetter southern areas.

Pulses

Only the more important of the numerous pulse crops grown in the Sudan are considered here.

Cowpea. Numerous types of cowpea (*Vigna unguiculata* and spp.) are cultivated throughout the Sudan. In wetter areas cowpeas are frequently attacked by an unidentified bacterial blight (probably *Xanthomonas phaseoli*) which, however, rarely seems to become severe.

In the very wet extreme south the crop is often devastated by a zonate leaf spot disease caused by an unidentified fungus; the spots are large, characteristically zonate and consist of several concentric rings of dead tissue surrounding an ashy-white center.

[1] Previous articles were published in the *FAO Plant Prot. Bull.* 2 : 75–77, 161–165. 1954.

This disease results in severe drying up of leaves and, in very severe attacks, death of the plant. Tiny black sclerotia or possibly discharged pycnidia are often present in the dead tissue but no spores have been found and the identity of the pathogen remains obscure; the symptoms resemble those caused by *Aristastoma oeconomicum* (Ellis & Tracy) Tehon on leguminous plants in the United States. In the Sudan, zonate leaf spot seems to occur only on Leguminoseae (cowpeas, grams, sann-hemp and wild *Vigna* spp.) and to be restricted to the extreme south where rainfall is heavy. In places it is extremely destructive and may lead to almost complete crop loss and abandonment.

A suspected virus disease with symptoms ranging from conspicuous leaf and plant distortion with indistinct mosaic to pronounced mosaic with little distortion occurs on cowpeas in some areas, notably in the Nuba Mountains where it can cause considerable crop loss. Severely attacked plants are badly stunted and distorted in growth, have reduced misshapen leaves, and bear few or no pods. Little is known of this disease. It is believed to be spread by the cotton whitefly (*Bemisia gossypiperda*); probably the breeding of resistant cowpeas offers the most promising prospect of control.

Rust, *Uromyces vignae*, is widespread and occasionally severe on cowpeas in wetter areas and as far north as the Gezira. Ashy stem blight, *Macrophomina phaseoli*, occurs but is of minor importance on this crop. Cercospora leaf spotting (most commonly *C. canescens*, sometimes *C. cruenta*) is widespread south of the Gezira and occasionally *C. canescens* causes considerable damage in wetter regions. Powdery mildew, *Sphaerotheca fuliginea*, occasionally causes leaf shedding of cowpeas in the northern Sudan and sooty mould (mostly *Cladosporium* and *Alternaria* on insect honeydew) is common but rarely severe.

Haricot bean. Haricot bean (*Phaseolus vulgaris*) is grown throughout the Sudan, particularly as an irrigated winter crop in the north. In the latter area a virus disease locally known as " curly top " can occasionally cause almost complete crop failure. This condition is characterized by internode shortening and stimulated development of lateral shoots, thus giving infected plants a stunted, bushy appearance. The leaves tend to be reduced and cupped and severely infected plants become sterile. Little is known of this disease or its host range. It is thought to be spread by the cotton whitefly and to be encouraged by hot weather – some control can be obtained by delay of sowing until the cooler winter months. Various other suspected virus symptoms occur on haricot beans in the Sudan but none appears to be of much present importance.

Ashy stem blight, *Macrophomina phaseoli*, often causes considerable losses to haricot beans planted during the rains in the Gezira, less commonly to winter plantings; sowing in good well-drained soil together with careful cultivation and irrigation minimizes this disease.

Rust, *Uromyces appendiculatus*, frequently attacks haricot beans in the central and southern Sudan. Severely rusted plots are frequent and the disease undoubtedly causes considerable crop losses. This rust also occurs in the extreme north where rainfall is usually nil and presumably infects the leaf through water provided by the early morning dews of the cool winter months.

Leaf spotting diseases caused by *Cercospora canescens*, *Ascochyta phaseolorum* and *Isariopsis griseola* commonly occur in wetter areas but cause only slight over-all damage.

Broad bean. Broad bean (*Vicia faba*) is grown extensively as an irrigated winter crop north of Khartoum. In some seasons yields are reduced by 50 percent and more by severe outbreaks of powdery mildews which cause widespread leaf shedding and drying up of the plants. *Leveillula taurica* and *Erysiphe polygoni* are mainly responsible and appear to be favored by dry climatic conditions, especially so during warm winters when severe outbreaks tend to develop. Control by dusting or spraying of sulphur fungicides is being investigated since beans are an important field crop in Northern Province.

A destructive and puzzling disorder of broad beans in the latter area is the so-called " chocolate spot " which causes extensive leaf damage in some seasons. The nature of this condition remains obscure; although symptomatically akin to chocolate spot of broad bean caused by *Botrytis fabae* in Europe and Egypt, no fungus seems to be consistently associated with the Sudan

disease. Possibly it sometimes results from aphid attack but no detailed investigation has been made.

Other bean diseases include rust (*Uromyces fabae*), which sometimes causes appreciable leaf damage, and various uninvestigated root rots of little practical importance.

Other pulse crops. These are many and varied. The more important diseases include leaf spot (*Cercospora cajani*) and powdery mildew (*Leveillula taurica*) on pigeon pea (*Cajanus indicus*); rust (*Uromyces appendiculatus*), leaf spot (*Cercospora canescens*, *Ascochyta phaseolorum*), ashy stem blight (*Macrophomina phaseoli*) and zonate leaf spot (discussed above) on grams (*Phaseolus aureus*, *P. mungo*); powdery mildews (*Leveillula taurica*, *Erysiphe polygoni*) and leaf spot (*Cercospora canescens*) on garden pea (*Pisum sativum*); rust (*Uromyces mucunae*) and an unidentified bacterial blight on velvet bean (*Mucuna* sp.). In the Gezira and southwards soybean (*Glycine max*) is often severely attacked by bacterial blight thought to be caused by *Xanthomonas phaseoli*.

Vegetables

Crucifers. Various brassicas, including cabbage, cauliflower, kohlrabi, turnip, swede, rape, Indian mustard (*B. juncea*) and colza (*Brassica campestris* var. *sarson*) are cultivated in gardens throughout the Sudan, especially so in the north. They are attacked by numerous minor diseases including leaf spotting caused by *Alternaria brassicicola* (often severe in the wet southern areas), *A. brassicae* (less common) and *Cercospora brassicicola* (widespread but rarely destructive). In the north powdery mildews, mainly *Leveillula taurica* and *Erysiphe polygoni*, sometimes cause slight damage to colza, Indian mustard and turnip. Various unimportant and uninvestigated virus-like symptoms are occasionally observed on brassicas in the Gezira. Diseases of common occurrence in other countries, such as downy mildew (*Peronospora parasitica*) and club root (*Plasmodiophora brassicae*), however, have not been found in the Sudan although the latter has been reported from South Africa.

Cucurbits. Vegetable marrows, cucumbers, sweet and water melons, pumpkins and other cucurbits are grown in most parts of the Sudan. In the central and southern areas where average annual rainfall exceeds 15-20 inches some cucurbits are attacked by downy mildew, *Pseudoperonospora cubensis*, which at times causes considerable leaf damage and loss of crop. Cucumber is particularly susceptible, sweet melon and pumpkin are less commonly attacked. In the drier north downy mildew is replaced by various powdery mildews of which *Leveillula taurica*, *Erysiphe cichoracearum* and *Sphaerotheca fuliginea* have been identified; they are very widespread and often cause considerable loss in yield and quality of the crop. *S. fuliginea* is the commonest and is found on cucumbers, marrows and pumpkins almost everywhere in the Sudan; the other two mildews tend to be restricted to the dry north. Leaf spotting diseases caused by *Alternaria cucumerina* and *Cercospora cucurbitae* commonly occur on wild and cultivated cucurbits in areas where annual rainfall exceeds 15-20 inches but rarely cause more than minor damage. Uninvestigated mosaic and leaf-distortion diseases, probably of virus origin, occasionally cause severe local damage but are of little over-all significance.

Alliaceous vegetables. Alliaceous vegetables are remarkably free from diseases, the only ones recorded being powdery mildew (*Leveillula taurica*) of garlic and black storage mould (*Aspergillus niger*) of onions; neither is of much practical importance.

Root vegetables. Sweet potato (*Ipomoea batatas*) and cassava (*Manihot utilissima*) are important root crops and have the advantage that their edible tubers are not liable to consumption by locusts. Sweet potatoes are grown throughout the Sudan and in the south suffer from an unidentified and uninvestigated virus mosaic which is said to be severe in some seasons. Leaf spotting (*Phyllosticta batatas*) is very common in wetter areas and sometimes causes moderately severe leaf damage. Charcoal rot of the tubers caused by *Macrophomina phaseoli* is occasionally found but does not appear to be of economic importance.

Cassava is extensively grown in the southern Sudan, in which area most native cultivations are infected by cassava mosaic virus to varying degrees. This disease causes heavy crop losses and a high level of infection tends to result from the vegetative method

by which cassava is largely propagated. In the field cassava mosaic is said to be spread relatively slowly by its insect vector, the cotton whitefly; practical control of the disease might be obtained by regular roguing of infected plants and selection of planting material exclusively from healthy plants. Certain local varieties appear to show resistance but susceptible cassavas are often preferred by the consumers. What appears to be the same disease also occurs on the Ceara rubber tree (*Manihot glaziovi*). Leaf spotting (*Cercospora henningsii*) is very prevalent and occasionally causes appreciable leaf shedding.

Potatoes (*Solanum tuberosum*) are grown in small areas in the northern and southern Sudan and in the latter area are sometimes attacked by early blight (*Alternaria solani*), late blight (*Phytophthora infestans*) and various suspected unidentified virus diseases.

Okra. Okra (*Hibiscus esculentus*) is cultivated in all parts of the Sudan and often suffers severely from diseases and pests. In all areas and particularly in the north, powdery mildews cause wide-spread and often heavy crop losses which could probably be economically reduced by sulphur dusts or sprays; *Leveillula taurica* and *Erysiphe cichoracearum* are common in the north and *Sphaerotheca fuliginea* is also prevalent in wetter areas further to the south.

Leaf curl, caused by the cotton leaf curl virus, occurs on okra throughout the country and is especially serious in the north where the cotton whitefly vector is more abundant. In some areas this virus causes heavy crop losses. The disease can be controlled by crop sanitation measures but in most areas these are impracticable and more effective control would be obtained by growing resistant varieties, several of which have been selected.

Relatively minor diseases of okra include leaf spotting caused by *Cercospora abelmoschi* (widespread and occasionally fairly severe in wet areas), *C. malayensis* (less common) and *Ascochyta abelmoschi* (infrequent). Sooty mould, consisting largely of *Cladosporium* and *Alternaria* on insect honeydew, is common but rarely of much importance in the northern Sudan.

Tomato. Tomato (*Lycopersicum esculentum*) is cultivated throughout the Sudan and often suffers from an unidentified and somewhat ill-defined virus disease known as leaf curl. The virus is spread by the cotton whitefly and is not known to be transmitted in any other way. It can be very severe in the northern Sudan during hot weather and sometimes causes more or less complete crop failure. In the relatively few places where it can be enforced a close season for tomato cultivation has proved beneficial. This disease often causes severe damage and some work on the breeding of resistant varieties has been carried out.

Uninvestigated mosaic and other virus-like symptoms occur on tomatoes in most parts of the country. Leaf mould (*Cladosporium fulvum*) and leaf spot (*Septoria lycopersici*) are widespread and at times destructive in areas with annual rainfall exceeding about 20 inches. Powdery mildew (*Leveillula taurica*) is sometimes moderately severe on tomatoes in the north. Fruit rotting following insect or mechanical damage is not uncommon in wetter areas and blossom end rot, usually considered to be a non-parasitic condition associated with water strain in the plant, occasionally occurs in the north and at Port Sudan. Leaf spotting and fruit rotting caused by *Phoma destructiva* have been recorded in the Sudan but have not been collected in recent years. Among other tomato diseases may be mentioned leaf spotting caused by *Alternaria solani*, which is occasionally severe in wetter areas, and by *Cercospora nicotianae* and *Corynespora cassiicola*, neither of which is of much significance at present.

Other vegetables. Diseases of other vegetables include white blister (*Cystopus portulacae*) commonly occurring but rarely severe on purslane (*Portulaca oleracea*) in all but the driest parts of the Sudan, leaf spotting (*Dichotomophthora portulacae*) of the same plant in the central Sudan and Red Sea coast, leaf spotting of lettuce caused by *Cercospora longissima* and *Septoria lactucae* sometimes causing extensive leaf damage in the south, powdery mildew (*Leveillula taurica*) and leaf spotting (*Cercospora solani-melongenae*, *C. melongenae* and *Alternaria solani*) of eggplant (*Solanum melongena*) and many others. Although sometimes locally severe none of these is of much over-all importance and no control is attempted.

Oak Tortrix and Its Control in Spain

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IN Spain, the oak tortrix, *Tortrix viridana* L., causes considerable damage in groves of holm oak (*Quercus ilex*) which is the main source of edible acorns. The eradication of this and other oak pests by systematic treatment of large areas can change the economy of the entire region and raise the standard of living.

The Spanish Forest Pest Service, in the spring of 1954, treated 50,000 hectares of holm oak groves in the provinces of Madrid, Toledo, Cáceres, Badajoz, Huelva, Seville, Cordoba and Cadiz. The treatment has brought about significant increases in acorn production in these areas. In many estates where for years there had been no crop, the yield is now 400 to 800 kg., and occasionally reaches 1,000 kg., of acorns per hectare.

Holm Oak Groves in Spain

The geographical distribution of holm oak extends throughout the Mediterranean region but optimum conditions for its growth occur in the west, particularly in the Iberian Peninsula under the influence of the Atlantic climate.

Holm oak will grow on all soils in Spain and under various climatic conditions but its true climatic requirements can be met only in the xerophytic and mesoxerophytic zones of what is called dry Spain. It withstands drought and light intensity peculiar to the Mediterranean climate and also the sudden changes in temperature that are characteristic of the tableland. These characteristics, together with its resistance to external agents such as insects, fire and cutting, make the holm oak the typical tree species of the climax forests of over three-quarters of the country.

At present only about one million hectares of the original holm oak forests remain and as a result of their intensive utilization, the composition of the present stands does not resemble the primeval climax forests. The acorns of holm oak are used for feeding livestock, especially hogs, the basic source of wealth of many regions. Attention to acorn production, combined with the utilization of the ground for pasture and crops, has reduced tree density until the present status of forest–pasture has been reached. The number of trees per hectare varies between 15 and 70, with an average of 40. Since the trees are periodically pruned, their habit has also changed. This degradation of the holm oak climax forest has certainly decreased its resistance to pests.

Life Cycle of Oak Tortrix

Tortrix viridana, commonly called "lagarta," "oruga" or "brugo" in Spain has the following annual cycle. The overwintering egg hatches in the early spring and the young larva penetrates a bud on which it feeds. As the bud opens and the shoots develop, the larva eats the tender leaves and forms a shelter by joining two or three leaves with silk filaments. Sometimes the larva forms its shelter between staminate catkins or between the catkin and the leaf. When the pistillate flowers are destroyed, no fruit will be produced (Figure 1).

About three or four weeks after hatching, the larva pupates inside a shelter between two leaves, or in a rolled-up single leaf. Two or three weeks later the moths emerge in swarms and fly around the tree tops. Eggs are laid on young twigs, under a protuberance or in a cavity or often at the junction of branches.

Pests Associated with Tortrix

Tortrix viridana occurs in the holm oak groves usually in association with other lesser pests, chiefly the tent caterpillar

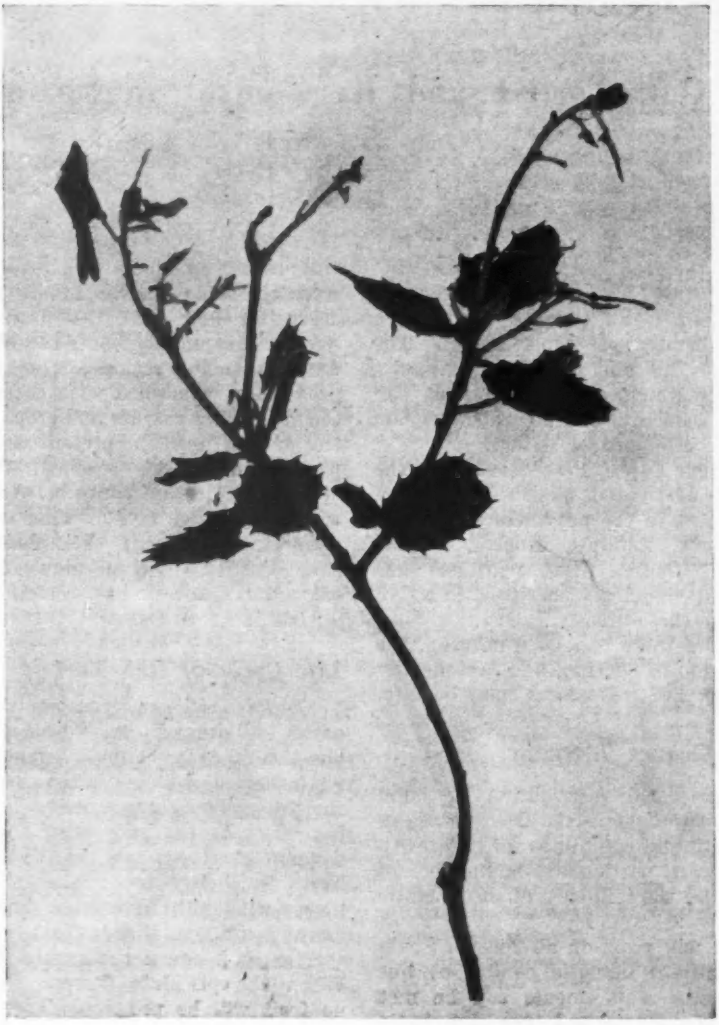

Figure 1. Holm oak shoots attacked by *Tortrix viridana*.

(*Malacosoma neustria* L.), the gypsy moth (*Porthetria dispar* L.), some other Tortricids and Geometrids.

In some areas *Malacosoma neustria* is occasionally the major pest, but its importance in comparison with the less obvious *Tortrix viridana* may be exaggerated. The life cycles of these two insects are very similar but the habits differ. After hatching, the caterpillars of *M. neustria* gather in large silken webs and devour tender leaves. In the later stages, they also feed on older leaves but cause less damage to the shoots and pistillate flowers, so that although the trees may be more defoliated, some fruiting is possible.

Porthetria dispar now appears only in isolated, small infestations within the range of *Tortrix viridana* but during the past few decades it was destructive to holm

oak in extensive areas. It has recently migrated towards the periphery of the peninsula, probably owing to the competition of *T. viridana*. Nevertheless it is still the chief pest in the most northerly holm oak groves of the province of Salamanca, and often causes some damage in the cork oak (*Quercus suber*) groves of Cádiz and Gerona, the holm oak groves on the eastern coast and various oak woods on both slopes of the Cantabrian Mountains. The recently renewed forests of Monterey pine (*Pinus radiata*) in the north of Spain were also severely attacked by this pest but in 1952 and 1953 the foci of infestation were brought under control.

The outbreak areas of *Tortrix viridana* and important foci of infestation of *Porthetria dispar* are shown in Figure 2.

Losses

The three pests mentioned above cause very severe losses. For many years heavy infestations of *Tortrix viridana* and its associates, in over 700,000 hectares, have reduced the productivity of the holm oak groves to a quarter of the original.

Some groves now produce practically no acorns, though most yield some crop during years when climatic conditions are unfavorable to the pest or when natural

Figure 2. Outbreak areas of *Tortrix viridana* and important foci of infestation of *Porthetria dispar* in Spain. The former are indicated by shaded areas and the latter by black dots, the size of dots being in proportion to the relative importance.

parasitization occurs. The present average yield of the infected groves is estimated at 150 kg. of acorns per hectare per year, while normal average production should be about 600 kg. Thus the annual loss of 450 kg. of acorns at 1.50 pesetas[1] per kg. equals 675 pesetas per hectare or 472.5 million pesetas per year for the total 700,000 hectares. Adding the loss of revenue from secondary uses and the reduction of tree vigor, the total annual loss is estimated at over five hundred million pesetas.

Factors Affecting Chemical Control

The best time to attack *Tortrix viridana* is at the stage when the larvae hide in shelters and are much less protected than when they are feeding inside the bud, and when they also move about more. This stage lasts about 20 days within the period between the end of March and early May, when the tree bears young shoots from 3 to 10 cm. long and the larvae feed on new leaves. As heavy rains usually occur during this period, only about ten days are likely to be suitable for control operations.

In order to obtain maximum control of this pest, a number of insecticides and various types of equipment have been tested. Synthetic contact insecticides are preferable to stomach insecticides, because a stomach insecticide may kill some larvae but many will survive to feed on leaves produced after treatment.

In selecting suitable equipment for applying insecticides, two factors are regarded as important. First, it should be capable of delivering liquid or powder in very fine particles, in order to penetrate the interstices of the insect's shelter. Second, it should be easily maneuverable under varying conditions.

High-volume spraying cannot be adopted over large areas because of the great quantity of water that has to be hauled, especially as water supply is usually not available in the oak groves. Furthermore, the maneuvering of the heavy equipment is difficult and the rate of application is slow, some 10 hectares per unit per 10-hour work day.

The use of low-volume sprayers has reduced haulage. With concentrated oil solutions, 20 to 25 liters suffice to cover one hectare. The equipment used for this work was "Swissatom," manufactured by Berthoud, A. G. in Switzerland. It is, however, a heavy machine and its rate of application was not high, only about 25 hectares per day.

Fog machines reduce further the amount of liquid required to 6 to 10 liters per hectare and are capable of covering 60 hectares per three-hour work day. Several types were tested; among them were "Borchers Nebelgerät" manufactured by Borchers in Germany, and "Todd Insecticidal Fog Applicator" (TIFA) manufactured by the Lister-Todd Engineering Corporation in England. Their heavy weight is still a serious disadvantage and prevents their use on rough terrain. Furthermore, they can be used only in still weather, i.e., about three hours a day.

Two types of power duster have been used, weighing over 200 kg. empty and 260 kg. loaded, and 35 kg. empty and 60 kg. loaded, respectively. The heavy duster, like all the other equipment mentioned, is pulled by draft animals or tractor, and therefore can only be used on flat ground. It can cover 40 hectares per three-hour work day. The lighter duster, mounted on a wheelbarrow and operated by two men, is very easy to maneuver and can be used anywhere. It is capable of covering 30 hectares per five–hour work day. Considering its weight and cost, this rate of operation is extremely good.

Two types of fixed–wing aircraft, one of 450 h. p. and another of 135 h.p., were hired during the operation. In order to minimize drift, the particle size of powder or liquid droplets emitted could not be too fine, and thus the effectiveness was reduced. Spraying was found to be more costly and less effective than dusting. Even with dusting, aircraft did not compare favorably with the power duster in economy, because the dust cloud emitted by an aircraft must be denser than that formed by ground equipment; hence the need for more insecticide per unit area.

Flying at heights of 5 to 15 m. above tree–tops, the heavier plane is capable of dusting 100 hectares per hour and the lighter plane 75 hectares. Aerial treatment, however, can be undertaken only two hours a day at dawn and evening, when air movement is at a minimum but visibility is adequate

[1] One peseta = .0254 U.S. dollar.

The increase in power and in load-carrying capacity of the aircraft is not proportionate to the increase of efficiency, because an aircraft with higher power requires a larger airfield, which is usually further away from the oak groves.

Under the prevailing conditions in Spain, the cost of treatment per hectare with different types of equipment, including the operation, maintenance and depreciation of the equipment, the insecticide and transportation, are computed as follows:

High–volume sprayer	160	pesetas
Low–volume sprayer	150	,,
Fog machine	165	,,
Heavy power duster	135	,,
Light power duster	116	,,
Aircraft, 450 h.p.	280	,,
Aircraft, 135 h.p.	220	,,

All factors considered, dusting with lighter wheel-mounted dusters appears to be the best method for the control of holm oak pests. Success, however, depends on knowing how to apply the dust and many treatments have failed owing to improper application. For the formation of suitable dust-clouds which will drift over the stand, the weather must be almost completely calm with air movement of less than 1 m. per second, which normally occurs only in the early morning and late afternoon, in all for about three hours a day, and at certain hours of the night.

Experiments carried out with various chemical compounds have led to the selection of DDT, applied at about 1 kg. of the active ingredient per hectare. The reduction of the amount of diluent is limited by the need to distribute the active ingredient evenly. Practice has shown that 8 to 12 kg. of powder are adequate to dust one hectare of holm oak grove and 10 percent DDT preparation was chosen, usually diluted with kaoline. The powder must be fine enough for 95 percent to pass through a 200–mesh sieve. A higher percentage of *p-p'* isomer of DDT greatly increases the effectiveness and rapidity of the insecticidal action. Using this method the mortality of *Tortrix viridana* varies from 95 to 99 percent. All the larvae in the vulnerable stage of development are killed but, as the holm oak trees do not produce new shoots simultaneously, some larvae not in this stage may survive.

Virus Diseases of Gladiolus in the United States[1]

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THE gladiolus is host to numerous viruses, many of which also affect important food crops as well as other ornamental plants. Corms of this popular plant are largely grown on the West Coast and shipped throughout the country. Since infected corms are an excellent means of dissemination, the virus situation in corm-producing areas is a matter of widespread interest. Furthermore, corms saved from one season to the next may serve as local centers for infection and spread, so that even without new introductions the virus content of gladiolus plantings is not a negligible circumstance.

Gladiolus Virus Survey in Oregon

Gladiolus in Oregon covered 429 acres in 1953. Since there is considerable interest in the growing of virus-free corms, a survey for gladiolus viruses in Oregon was made in 1954 to obtain data for a clean-up program.

By making inspections when most of the varieties were in bloom it was possible to examine for both foliar and floral virus symptoms simultaneously. Over 240 acres were surveyed. For the foliar viruses the percentage of virus-infected plants was determined by counting ten samples of ten plants each at random places in the field. The flower viruses were less frequent and only the names of the varieties affected and the approximate amount of disease were recorded.

The virus situation in gladioli is complex. Several strains of a virus or even different viruses may be responsible for a given symptom. Positive identification of the viruses concerned depends on techniques not available for the survey, and virus differentiation was based entirely on the expression of symptoms on gladioli under field conditions, as follows:

Cucumber mosaic virus. Cucumber mosaic virus infection in gladiolus is manifested in a wide range of symptoms. Chlorotic mottling is most prominent on the outer leaves. Typical symptoms are small squares between two veins of the leaves. Severe cases can be recognized readily, because of the yellow appearance of the plants, while mild cases are often visible only when a leaf is held against the light.

Ringspot virus. The typical ringspot virus symptoms appear on the central leaves. The rings are from 1 to 3 mm. in diameter and are usually chlorotic with a dark green center. Often cucumber mosaic virus and ringspot virus symptoms are observed on the same plant.

Ring pattern. The chlorotic rings are larger than in ringspot virus infection, of irregular shape and enclose up to ½ cm. square of leaf area. This condition has been reported as a strain of the ringspot virus. In this survey chlorotic ring pattern was not found very frequently.

Yellow bean mosaic. This is a latent virus and is often present in plants without showing symptoms. It is probably a component of many virus mixtures. To demonstrate this virus with certainty inoculations are necessary.

White streak on flowers. White streak can be seen only when the gladioli are in bloom. Plants with leaves showing cucumber mosaic virus symptoms often may produce healthy flower spikes, whereas some plants with white streak affected flowers have leaves that show only mild foliar virus or none at all. White streaks or white breaks in the flower petals are characteristic of this diseased condition. These symptoms may also be seen in the bud stage. Usually

[1] This report is based upon material submitted by collaborators of the Plant Disease Epidemics and Identification Section, Agricultural Research Service, United States Department of Agriculture.

the flower is distorted and smaller than usual. The reduction of the spikes to small stubby heads may also be associated with this virus.

Western aster yellows. Three plants were found with a green bud condition. The flowers did not open and the petals were green, and the leaves of the affected plants were yellow and brown.

Results of the survey. The average amount of foliar virus was found to be 21 percent. This amount, however, included mostly mild forms, and only about 1 percent of the plants with cucumber mosaic virus symptoms could be classed as severe.

Ringspot virus and cucumber mosaic virus were difficult to differentiate on the basis of field observation alone. For purposes of the clean-up program it seemed more practical to assemble them under the term foliar viruses. Yellow bean mosaic and the ring pattern condition also were classified in this group.

The flower viruses included white streak and western aster yellows. The percentage of white streak found in northern Oregon was low and restricted to a few varieties. Only two plants with white streak were found in southern Oregon and none in eastern Oregon. In 1951 up to 2 percent on one variety was reported. Apparently roguing of affected plants has markedly reduced this disease.

For an effective control, roguing of all plants showing white streak and western aster yellows is absolutely necessary. At the same time plants with severe cucumber mosaic virus and ringspot virus symptoms should also be pulled out. By this procedure virus infection should gradually be reduced to a negligible amount.

The fact that so little white streak was found as compared to other years shows that the clean-up program initiated by the Oregon Department of Agriculture and followed by the growers is attaining success.

Aphid Transmission of Tobacco Ringspot Virus in Gladiolus

The tobacco ringspot virus is common in gladiolus. It has been associated with stunt, white break and corm ringspot, but a causal relation has not been proved. Possibly the most frequent association is with white, yellow, or brown flecking and streaking in gladiolus leaves. Some symptoms of this type apparently are caused by the tobacco ringspot virus and others by the cucumber mosaic virus. The symptoms of brown and white streaking had been duplicated as early as 1944 at the Plant Industry Station, Beltsville, Maryland, by aphid transmission from gladiolus to gladiolus seedlings, but the causal virus was not identified at that time.

After detection of tobacco ringspot virus in gladiolus was reported, a stock of previously inoculated gladiolus at Beltsville was tested for this virus. It was found in one group of gladiolus seedlings that had been exposed in January 1950 to green peach aphids, *Myzus persicae* (Sulz), transferred from naturally infected white-streaked gladiolus. Nine of 13 plants exposed developed white streaking comparable to that expressed by the source plant. In four separate index trials, tobacco ringspot virus was recovered from these seedlings each time, twice in company with bean yellow mosaic virus and twice alone.

An April 1954 another transmission trial was made by transferring green peach aphids from these infected gladiolus seedlings to ten healthy gladiolus seedlings. One of these plants expressed white streaking in leaves; this plant yielded only tobacco ringspot virus on indexing. The two cultures of tobacco ringspot virus isolated from these two tests are somewhat less virulent to tobacco than the type strain but they fully protect tobacco against superinfection by the type strain. The test seedlings used in both insect-transmission trials were from a single seedling clon, produced from a single seed and propagated in greenhouse culture only. No virus contamination has been detected in this clon, and virus index tests of unexposed plants of the clon have been consistently negative.

Since no alternative explanation is available for the presence of the tobacco ringspot virus in these two groups of inoculated seedling gladiolus, the green peach aphids must have transmitted the virus. It is not certain that the presence of a mosaic virus in combination is required for aphid transmission of the tobacco ringspot virus, as has

been suggested for " western ring spot virus " in leguminous plants. The hypothesis that aphids transmit ringspot viruses only in company with mosaic viruses is tenable but difficult to confirm in gladiolus. Viruses of the bean yellow mosaic group are prevalent in gladiolus. These are perhaps more difficult to detect than the tobacco ringspot virus by the usual index methods. Furthermore, a virulent tobacco ringspot virus produces severe necrotic effects in the bean varieties commonly used to detect the bean virus. When both viruses are present in the same plant, expression of the bean virus in some index tests is precluded.

Western Aster Yellows in Gladiolus in Kansas

In July 1954, a commercial gladiolus grower in Kansas sent 62 corms to the Plant Industry Station at Beltsville, Maryland, with the report that similar stock produced only thin multiple sprouts or failed to grow. He also reported that planting stock from the West Coast when irrigated had produced an apparently good crop of gladiolus in 1953, and the disease was not recognized until the 1954 season when large numbers of the gladiolus produced were affected.

When planted in a greenhouse at Beltsville all sample corms developed multiple sprouts, only 17 making sufficient growth to emerge above the soil. Thirty thin weak sprouts developed from a single corm. The symptoms agreed with those reported previously in gladiolus from Oregon in 1952 and were shown to be caused by western aster yellows virus (see *FAO Plant Prot. Bull.* 1 : 147–148. 1953). As far as known, this is the second instance reported of commercial loss from aster yellows in gladiolus and the first record of such loss in Kansas.

Outbreaks and New Records

Canada

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THE following records, made in 1953, are of insects new to Canada but previously reported elsewhere in North America. New Canadian records for 1953 of insects not previously reported in North America, some being of new species, were published earlier.

Vetch Bruchid

The vetch bruchid, *Bruchus brachialis* Fahr., was found for the first time breeding in Canada, in the seed of hairy vetch (*Vicia villosa*) at Grand Forks, British Columbia. Almost simultaneously it was intercepted, for the first time in Ontario, at Niagara, in vetch seed for export, grown on three separate farms in Norfolk County, Ont. A native of Europe, the insect was first recorded on this continent in New Jersey, U.S.A., in 1930. It was reported in Oregon in 1940 and was later taken in northwestern Idaho and in eastern Washington. It has greatly reduced the production of hairy vetch seed in the South Atlantic States and in Oregon and is causing some concern in British Columbia, where 24,000 pounds of hairy vetch seed were grown in 1952.

Aphid on Lettuce

Specimens of the aphid *Pemphigus balsamiferae* Williams were collected on lettuce at Winnipeg, Manitoba. Although observed on lettuce in the area in previous years, the insect had not been identified to species. Known as the poplar sugar-beet root aphid, it has been taken commonly in the Rocky Mountain region of the United States. Known winter hosts are *Populus angustifolia* and *P. tacamahaca*. In summer it occurs on the roots of both sugar and garden red beets (*Beta vulgaris*), *Chenopodium album*, *Achillea* sp., *Agropyron* sp., *Aster ericoides*, *Cycloloma atriplicifolium*, head lettuce (*Lactuca sativa*), *Poinsettia* spp., *Polygonum aviculare*, and *Solidago* sp.

Aphid on Chestnut

An aphid, *Myzocallis punctata* Monell, commonly called the clear-winged oak aphid, was collected from chestnut in a plant nursery on Lulu Island, British Columbia. Fifty sweet chestnut trees (*Castanea* sp.), up to 15 feet in height were moderately infested. Elsewhere in North America, the species has been reported from Colorado and Utah, U. S. A., where it infested the foliage of various species of oak (*Quercus* spp.).

Twig Borer on Maple

Larvae of a maple twig borer, *Proteoteras aesculana* Riley, were found in seeds of Manitoba maple (*Acer negundo*) in Carleton County, Ontario, in 1949 and 1950, and in the leaf buds of Manitoba maple and silver maple (*Acer saccharinum*) in nurseries in the Fonthill district of southern Ontario in 1951.

Borer in Viburnum

A viburnum borer, *Synanthedon viburni* Engel., was taken on a shrub, presumably *Viburnum* sp., at Guelph, Ontario. In the United States, the insect is known to occur only on Long Island and in Brooklyn Gardens, New York.

Leaf Miner on Turnip and Radish

Specimens of the leaf miner *Scaptomyza apicalis* Hardy were collected on the leaves

of turnip at Agassiz, British Columbia, and on radish at Ottawa, Ontario, and Abbotsford, Quebec. Although this is the first time that this species is reported in Canada, it is believed that the insect has been present for some time, being recorded as *S. flaveola* Mg.

A Gall-inhabiting Ant

A live colony of the ant *Leptothorax congruus* F. Smith was intercepted at Vancouver, British Columbia, in plant material from Japan. The colony was found in galls on a willow-like plant.

Federation of Malaya

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Acaphylla steinwedeni: a First Record

Material of the mite, *Acaphylla steinwedeni* Keifer, was collected in 1954 by R.J.A.W. Lever on tea in the Central Highlands, Pahang, Malaya, and subsequently identified by Dr. H.H. Keifer of the Department of Agriculture, California, U.S.A. This genus and species was described by Keifer in 1943 from ornamental *Camellia* in California and it is now recorded from tea in Malaya for the first time, although Dr. Keifer has previously received it from tea elsewhere in Asia.

Sierra Leone

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Hellula phidilealis: a First Record for Africa

Specimens of the Pyralid moth *Hellula phidilealis* Walk. were received from Mr. P.F. Prevett of the Department of Commerce and Industry, Sierra Leone, in April 1955. The larvae were reported to have been quite numerous on cabbages. Typically, the larvae bore into the growing point and leaf-axils of the host. This is the first record of the species in the Old World, although *H. undalis* (F.). which is also a pest of crucifers and has a wide distribution in the warmer regions of the world, occurs in Africa, Asia and Australia. *H. phidilealis* is stated [1] to occur in the Southern States of U.S.A. and has hitherto been obtained from Mexico and southwards, through Central America and the West Indies to Venezuela, Brazil, Paraguay and Argentina.

It appears highly probable that it is of fairly recent introduction to the African Continent.

[1] Forbes, W.T.M. The Lepidoptera of New York and neighboring States. *Mem. Cornell Univ. Agric. Exp. Sta.* 68: 551. 1923.

Swaziland

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The following records are based on material sent in for identification to the Commonwealth Institute of Entomology by the Colonial Development Corporation.

Trichispa sericea: a First Record

A serious outbreak of the Hispid beetle, *Trichispa sericea* Guer., occurred in March 1955 on irrigated rice at low altitudes in Swaziland. It has not been recorded previously as a pest of rice in that territory, although known to occur in other parts of southern Africa, and well-known as a pest of rice in Madagascar.

Ampycodes pallidicosta: a First Record

Larvae of the Pyralid moth, *Ampycodes pallidicosta* Hmps., were found boring in stems of irrigated rice at low altitudes in Swaziland in March 1955.

The only previous records of damage by this insect are from the Gold Coast (1946) and Nigeria (1953), both under its synonym *Rhinaphe vectiferella* Rag.

Plant Quarantine Announcements

Republic of the Philippines

Administrative Order No. 7, Series 1954 (Revised) providing for regulations governing the importation of living animals not falling within the term "domestic animals," published in the *Official Gazette* Vol. 50, No. 12, December 1954, replaces Plant Industry Administrative Order No. 7, Series 1946. The revised Order differs from the 1946 Order only in: (i) establishment of fees for permit and inspection and of bond for imported animals liable to become pests; and (ii) modification of the basis of fines in case of contravention of the regulations.

The introduction, for any purpose, of any living insect and any other animal falling within the term "domestic animals" as defined in Act No. 3639, is still prohibited, except upon production of a written permit from the Director of Plant Industry.

Union of South Africa

Proclamation No. 63 of 14 February 1955, published in the *Government Gazette* Vol. 179, No. 5426, 4 March 1955, amends Proclamation No. 286 of 1936 concerning restrictions on importation of plants, fruit, potatoes, etc. Under this new Proclamation, the importation of plants and seeds of sunflower (*Helianthus annuus*) from Brazil, Argentina, Union of Soviet Socialist Republics, Uganda or any other country where the virus disease known as mosaic occurs, is prohibited.

News and Notes

Latin American Congress of Genetics, Plant Protection and Soil Science

The Third Latin American Congress of Plant Geneticists, Phytopathologists, Entomologists and Soil Scientists will be held, at the invitation of the Government of Columbia, in Bogota and Medellin, 20 June to 1 July 1955. Dr. Eduardo Mejia Vélez of the Faculty of Agronomy, Medellin and Dr. Carlos A. Krug of the Institute of Agronomy, Sao Paulo, will serve as President and Secretary respectively.

The First Congress was held in Mexico City in 1951, dealing only with plant pathology and applied entomology. The Second Congress, held in Brazil in 1952, was attended by plant geneticists as well as plant pathologists and entomologists. For the forthcoming Congress, invitations have been extended to soil scientists in order to cover all branches of agricultural sciences relating to crop improvement.

The general sessions of the Third Congress will be divided into sections in accordance with subjects and crops, and much time will be devoted to round-table discussions to facilitate exchange of information and ideas, aiming at advancing co-operative studies. Further information and program can be obtained from Ing. Francisco Silva Parra, Executive Secretary of the Organizing Committee for the Congress, Apartado Aereo No. 568, Medellin, Columbia.

FAO Meeting on Wheat and Barley Breeding in the Near East

The Fourth FAO Meeting on Wheat and Barley Breeding in the Near East, held in Karachi, Pakistan, 14 to 19 March 1955, was attended by representatives from seven participating countries and several observers.

At the Meeting, a series of comprehensive reports were presented by delegates on progress in wheat and barley breeding in their countries. Those reports clearly indicated that as a result of the exchange of information, ideas and breeding material provided through the meetings, national improvement programs have been stimulated in many ways. Through tests carried out in the co-operative uniform rust and bunt nurseries during the last two seasons, many varieties have been selected, showing resistance to local races of rusts and bunt and promise for use as parental material in breeding programs in the region.

The Egyptian delegation presented a further report on the identification of races of wheat stem rust from Egypt, Syria and Jordan, based upon uredial material collected in 1954. This survey shows that races 14,17, 19, 21 and 24 continued to be the most prevalent races in those countries.

The races of wheat stem rust so far isolated in the Near East region are listed below. Entries for Egypt, Syria, Jordan, Cyprus and Turkey are based upon work conducted at the Egyptian Rust Laboratory, at Giza, while data for the Indo–Pakistan sub–continent are derived from records included in a paper presented by the Pakistan delegation.

Egypt: 9, 14, 17, 19, 21, 24, 42, 53, 53 A, 59, 69, 88, 123, El.
Syria: 11, 14, 17, 19, 21, 24, 34, 39, 53, 122.
Jordan: 14, 17, 19, 21, 24.
Cyprus: 17, 19.
Turkey: 11, 14, 21, 24, 34, 53, 122.
Indo-Pakistan sub-continent: 15, 21, 24, 34, 40, 42, 75, 117, 194.

The Meeting, in response to enquiries concerning methods of inducing epiphytotics and adequate pest infestation for the testing of breeding material, also made recommendations on standard techniques to be used for rusts, bunt and flag smut of wheat, net blotch and covered smut of barley and hessian fly.

Roma - Tip. del Senato del dott. Giovanni Bardi